Green Roofs: New Technology?

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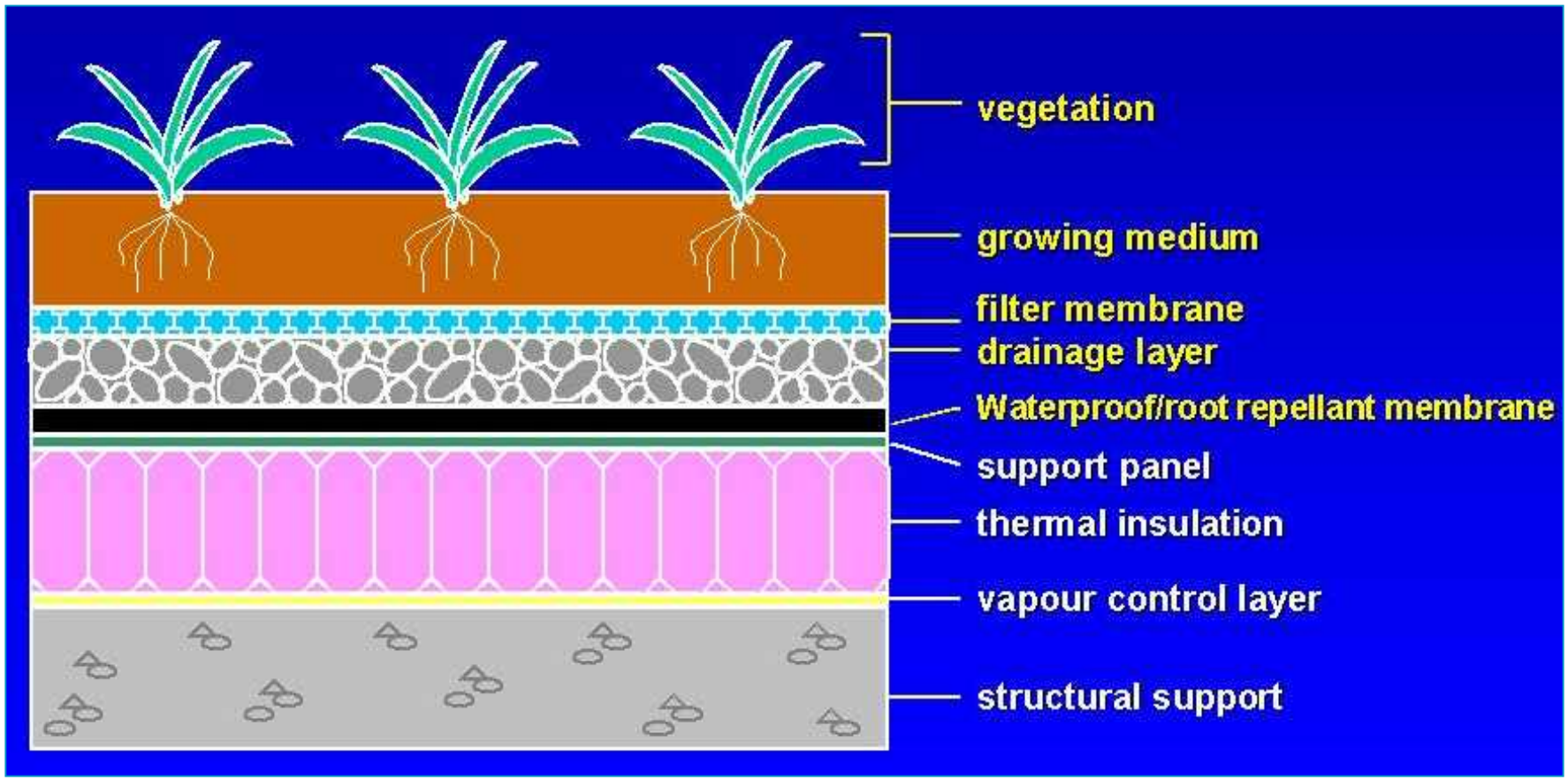
History

- Ancient
- Modern

Standard Green Roof Components

- Insulation
- Water Proofing
- Root Repellant Membrane
- Membrane Protection Layer
- Drainage System
- Filter Cloth
- Light Weight Growing Medium
- Plants

Standard Green Roof Components



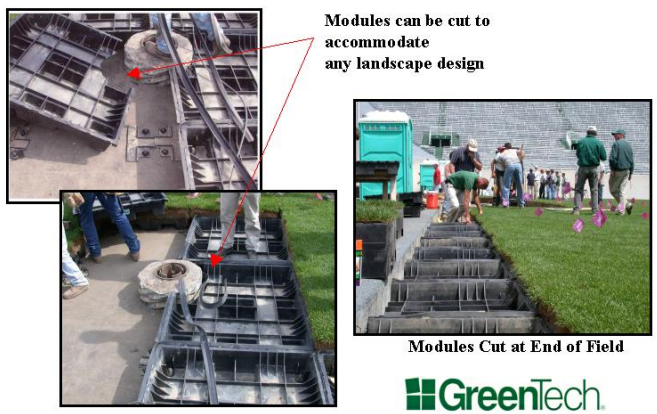
Plants Provide "Active Insulation"

- In summer, plants keep their leaves cool through transpiration and shade the ground; in winter, they shed leaves so sun can warm the roof—"active insulation"
- Selected plant types are climate- and site-specific:
  - Sedums
  - Succulents
  - Alpine
  - Desert plants

Types of Green Roof Systems

- Extensive Green Roofs
- Intensive Green Roofs
- Modular Systems

Module Contouring



Water Management—Reducing Runoff

- When rain falls on forested and open land:
  - 30% of the water reaches shallow aquifers that feed plants
  - 30% percolates and nourishes deeper aquifers
  - 40% is returned into the atmosphere through plant evaporation and transpiration
- In metropolitan areas:
  - 5% infiltrates to shallow and deep groundwater aquifers
  - 15% evaporates into the air through vegetation
  - 75% of the rainwater becomes surface runoff

- Studies show a direct link between runoff from impervious surface coverage and degradation of water quality in streams.
- Communities build expensive, unnecessary (?) drainage systems.

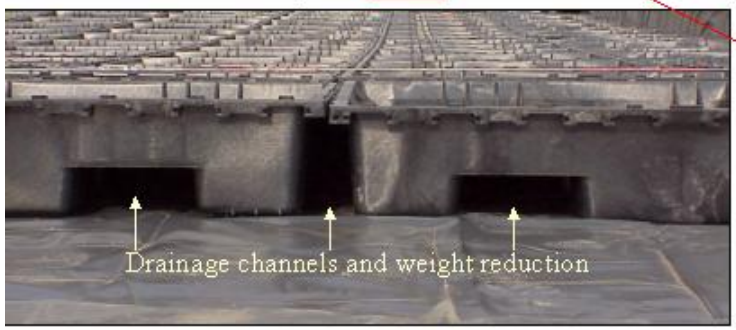
Water Management—Reducing Runoff

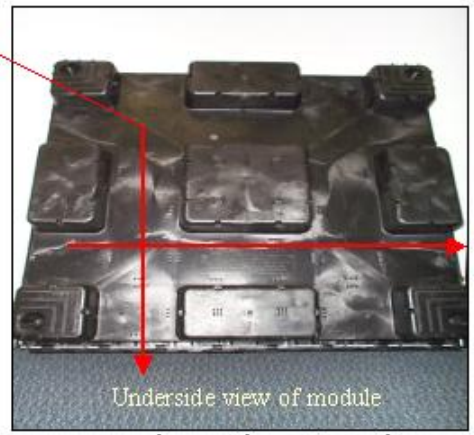
- Green roofs reduce runoff: on average:
  - 1-inch deep moss and sedum layer over a 2-inch gravel bed retains about 58% of water
  - 2.5-inch deep sedum and grass layer retains about 67%
  - 4-inch layer of grass and herbaceous vegetation retains about 71% of water
- When the green roof reaches full saturation, excess water slowly percolates through the vegetation layer to a drainage outlet

Water Management—Drainage Control

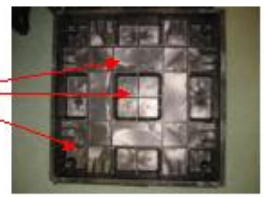
Tray Drainage Design

- With ITM, the fork lift channels & seam pockets equate to 6" pipes, 21" on center, in both directions





- Approximately 40 times more capacity to move air and water through soil profiles as compared to traditional designs.
- The system can be built to contain reservoirs of water for non irrigated applications



Reducing Urban Heat Island Effect

- "ASU, developers, cities search for ways to get Valley off heat islands" -- The *Arizona Republic*, Aug. 20, 2004*
- On hot days in Chicago for instance, temperatures atop the green-roofed City Hall are typically 25 to 80 degrees Fahrenheit cooler than the adjacent county office building with black tar roof*
- Researchers have found a dark roof in Northern CA in summer, has 150º temp. while nearby green roof has 77º temp.**

* Plant-Covered Roofs Ease Urban Heat, Donald Dawson for National Geographic News, November 15, 2002

** Green Roof Energy Benefits, SHADE Consulting, LLC

Energy & Emissions Savings

- Green roofs can reduce 5 - 15 %
  in building electricity use in summer*
- A study by Environment Canada also suggests that if 6 percent of Toronto's roof area was converted to green roofs, greenhouse gas emissions in the city would be reduced by 2.4 megatons a year*
- Annual heating and cooling costs can be cut 30% in Northern CA**

* Plant-Covered Roofs Ease Urban Heat, Donald Dawson for National Geographic News, November 15, 2002

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Other Beneficial Characteristics

- Air Quality Improvement—Net Benefits of CO_2 Sequestration, O_2 Production
- Doubles the Life Expectancy of the Water Proofing Membrane
- Aesthetic Benefits
- Acoustical Insulation by up to 50 db*

* Green Roof Energy Benefits, SHADE Consulting, LLC

Case Study—Sachs Residence

- Dan and Naomi Sachs, Chicago, wanted to create green and garden space on their back patio for their young children.
- The Sachs wanted an accessible and useable roof garden.
- The system was able to comply with strict weight requirements imposed by the condo association.
- Back yard could move with them if they ever moved.

U.S. Green Building Council LEED Certification

- Green Roofs can account for up to 17 out of a total of 69 LEED points, in the following areas:
  - Sustainable Sites
  - Water Efficiency
  - Energy Efficiency
  - Materials and Resources
  - Indoor Environmental Quality
  - Innovation in Design

Many applications…. Questions?